Environmentally Friendly Sprayable Ablator for the Solid Rocket Booster

Carl N. Lester/EH33
205–544–4804
E-mail: carl.lester@msfc.nasa.gov

Progress has been made in the continuing effort to qualify and implement an environmentally friendly replacement for the ablator previously used on the Space Shuttle SRB's—Marshall sprayable ablator–2 (MSA–2). MSA–2 performed well, but has been phased out because of impending environmental regulation due to its chlorinated hydrocarbon solvent system. Marshall convergent coating–1 (MCC–1), which was selected to replace MSA–2, originated from a United Space Boosters, Inc. (USBI) independent research and development (IR&D) project. The process was transitioned to MSFC's sprayable ablator research cell at the Productivity Enhancement Complex (PEC), where it was scaled up to production size, and where the process was refined and optimized. MCC–1 was qualified for use on the SRB, with the first flight of the material occurring on STS–79, which lifted off on September 16, 1996. The flight performance was a success and compared favorably with that of MSA–2.

MCC–1 is an innovative material that employs convergent spray technology (CST™), a solventless convergent spray process. MCC–1 utilizes an epoxy adhesive and ground cork and glass fillers (fig. 80), although various adhesives and fillers may be selected for other CST™ applications. It is robotically sprayed on a painted aluminum target located on a rotating turntable. A high-temperature cure provides the quickest processing timeline and provides optimum strength. After curing, the ablator is topcoated with a moisture-resistant paint to help maintain its strength and integrity while on the launch pad. Features of this process include on-demand availability and process robustness.

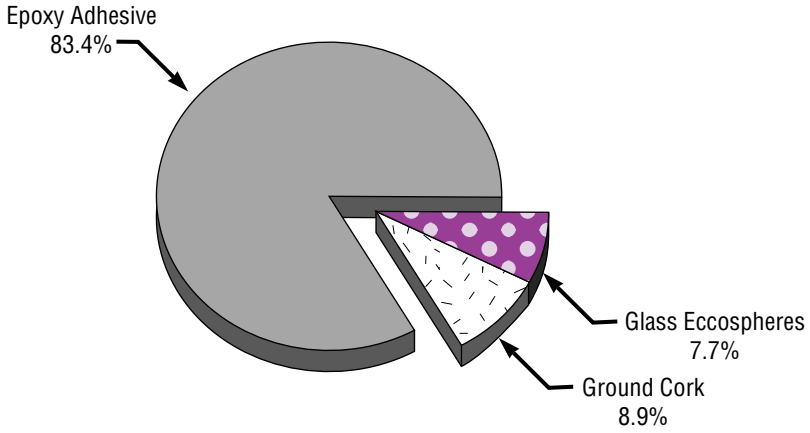

Figure 80.—Typical composition of MCC–1 in weight percentage.

The Air Force was sufficiently impressed with this material to participate in a joint effort to qualify MCC–1 for the Titan IV rocket payload fairings. The schedule calls for the first Titan IV production hardware to be coated with MCC–1 in June 1997. Many industry spinoffs using CST™ are possible, due to the ability to change out adhesives and fillers as necessary to meet the desired end-use material properties. For example, pilot projects are currently underway to use CST™ to produce environmentally friendly anti-skid coatings for highway concrete bridge decks, as well as environmentally friendly roofing materials for industrial buildings.

In qualifying and implementing MCC–1, the PEC at MSFC is fulfilling its mission as one of the nation's preeminent research centers. Considering the impending environmental regulation, the implementation of a compliant replacement for MSA–2 has been of critical importance to the Space Shuttle Program. This environmentally friendly material and its core technology, CST™, will be available for other uses as well, as evidenced by the Air Force Titan IV application and the spinoff pilot projects, and will reaffirm NASA's commitment to the ecology of our planet.

Patel, S.V.: "Development of an Environmentally Friendly Convergent Spray Coating and Optimization of Its Application Process Parameters." Aerospace Hazardous Materials Management Conference, Cincinnati, OH, September 1995.

Sponsor: Solid Rocket Booster Project Office, Office of Space Flight

University/Industry Involvement: United Space Boosters, Inc. (USBI)

Biographical Sketch: Carl Lester is a materials engineer with NASA's Materials and Processes Laboratory at Marshall, specializing in the development and qualification of nonmetallic coatings and thermal protection systems. He holds a degree in chemical engineering from the Georgia Institute of Technology.